

Shaped Pupil Coronagraph- Possible Wide FOV Designs for WFIRST Pupil 20180103

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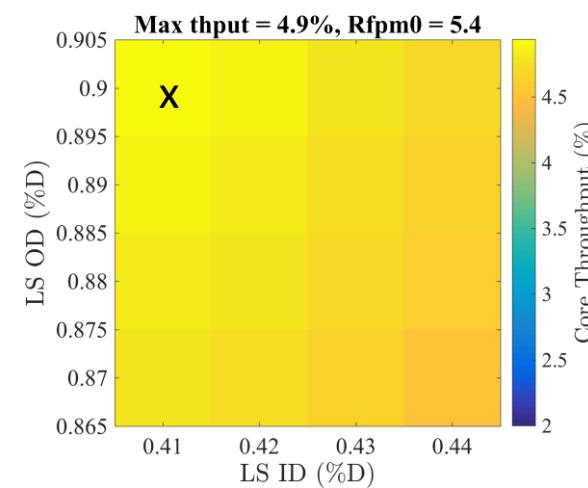
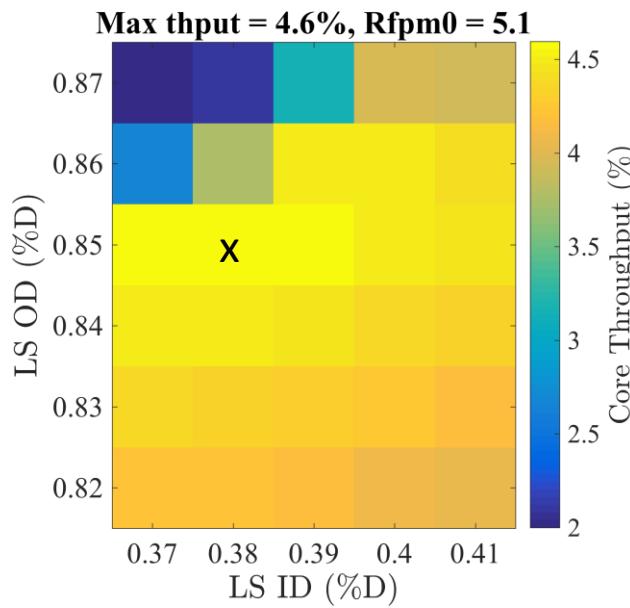
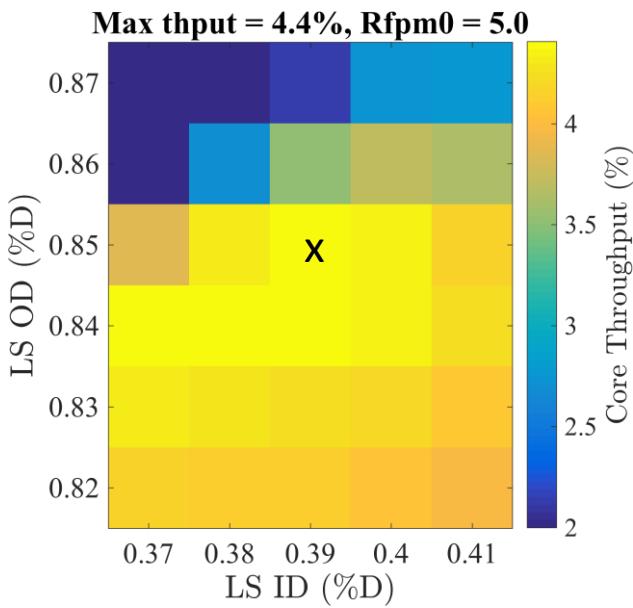
Jet Propulsion Laboratory,
California Institute of Technology

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The decision to implement the WFIRST mission will not be finalized until NASA's completion of the National Environmental Policy Act (NEPA) process. This document is being made available for information purposes only.



10% Bandwidth Options



FPM: 5.0-20 λ/D

LS: 39-85%

Thput: 4.4%

FPM: 5.1-20 λ/D

LS: 38-85%

Thput: 4.6%

FPM: 5.4-20 λ/D

LS: 41-90%

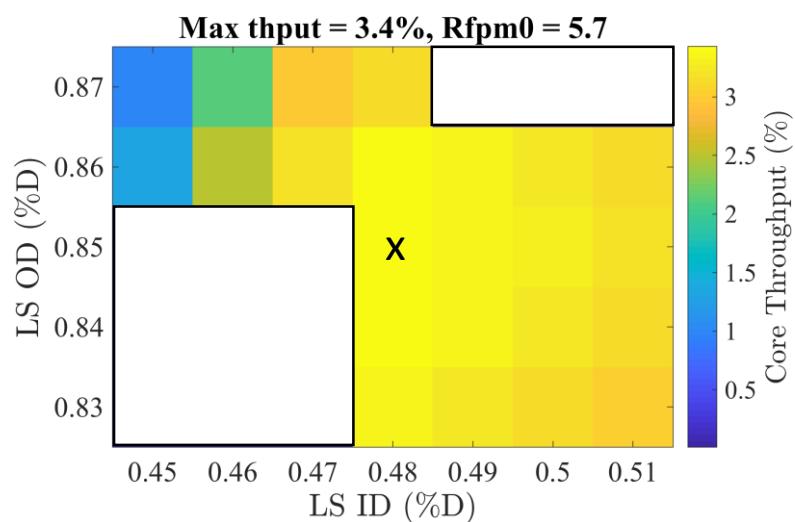
Thput: 4.9%

$$\text{Thput} * \text{BW} = 0.44$$

Note: IWA $\approx R_{fpm,inner} + 0.3$



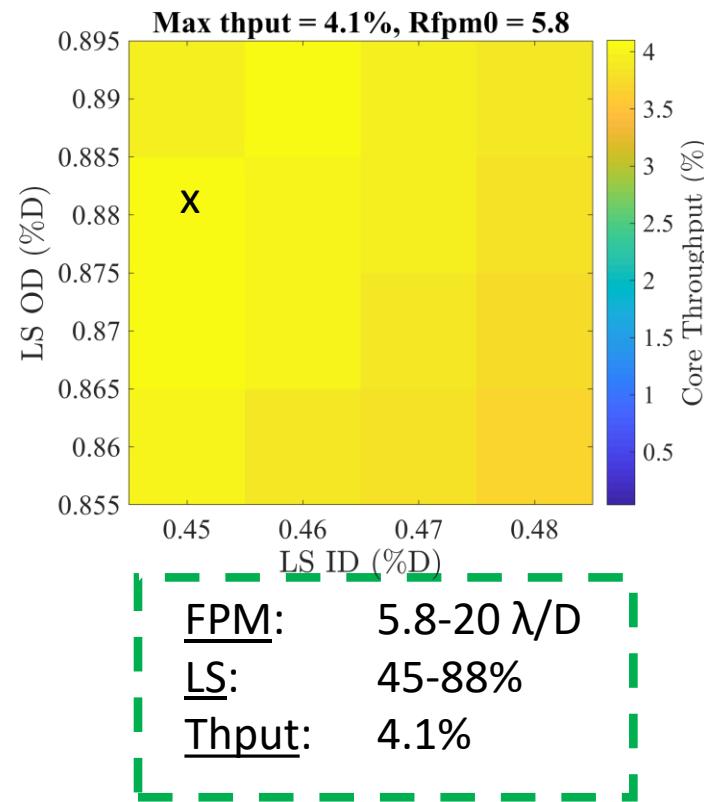
18% Bandwidth Options



FPM: 5.7-20 λ/D

LS: 48-85%

Thput: 3.4%



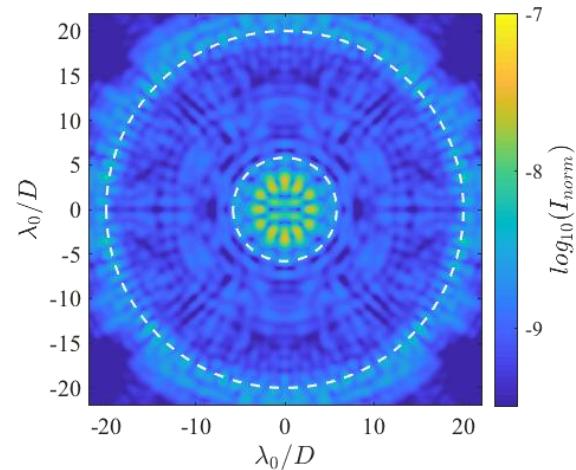
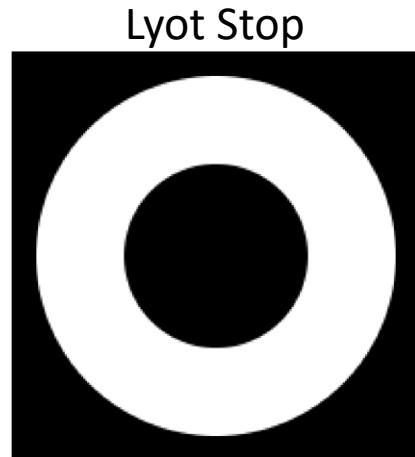
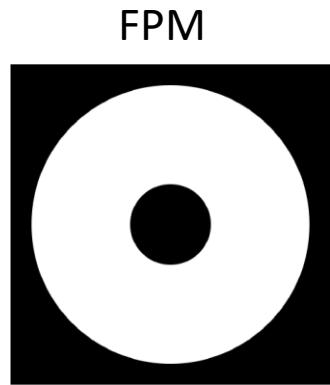
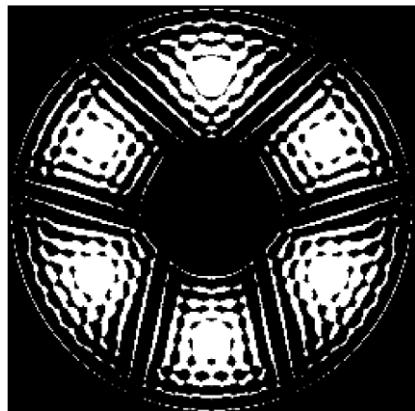
$$\text{Thput} * \text{BW} = 0.74$$

➤ $.74/0.44 = 1.7x$ the light of 10% design

Note: IWA $\approx R_{fpm,inner} + 0.3$

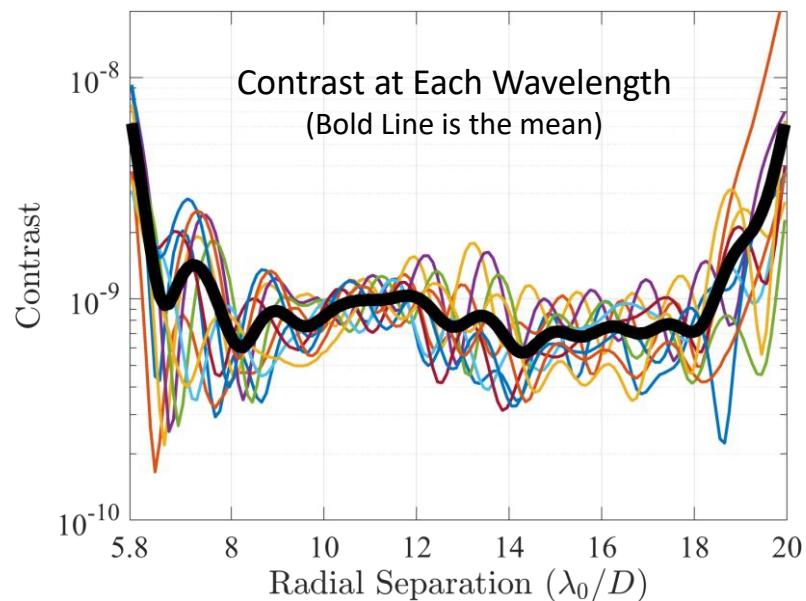


18% Bandwidth Design



Specs:

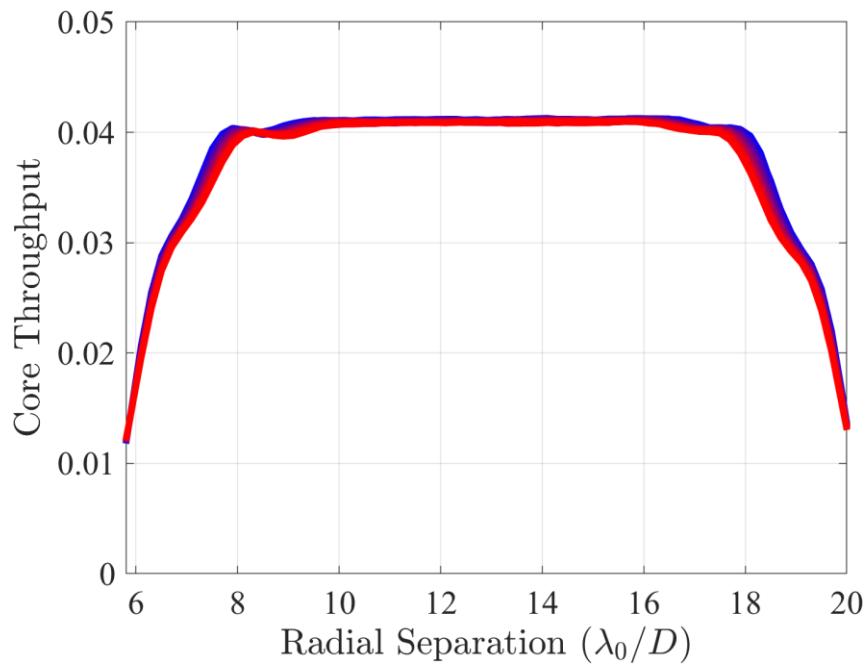
- 8.6×10^{-10} mean contrast ($6.1\text{-}19.0 \lambda_0/D$)
- FWHM core throughput = 4.1%
- FPM: $5.8\text{-}20 \lambda_0/D$ open area
 - IWA = $6.1 \lambda_0/D$ (half-max point)
 - OWA = $19.8 \lambda_0/D$ (half-max point)
 - 360-degree FOV
- 18% Broadband
- Annular Lyot stop (open from 45-88% of OD)
- Symmetrized WFIRST 20180103 pupil used
 - 1.0% OD cut off to block rollover
 - And +/-0.2% D input pupil padding



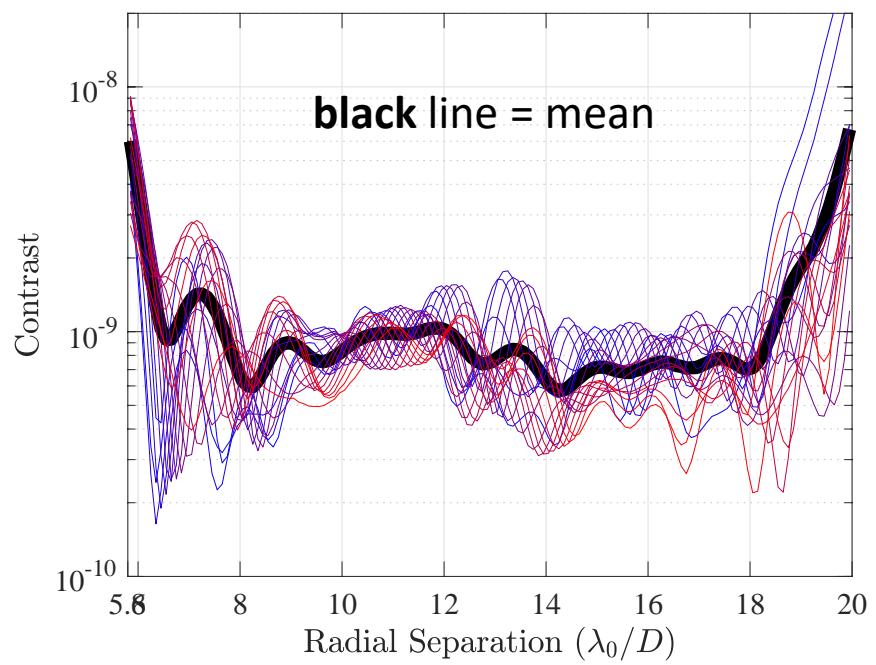


18% Bandwidth Design

Core Throughput



Designed Raw Contrast

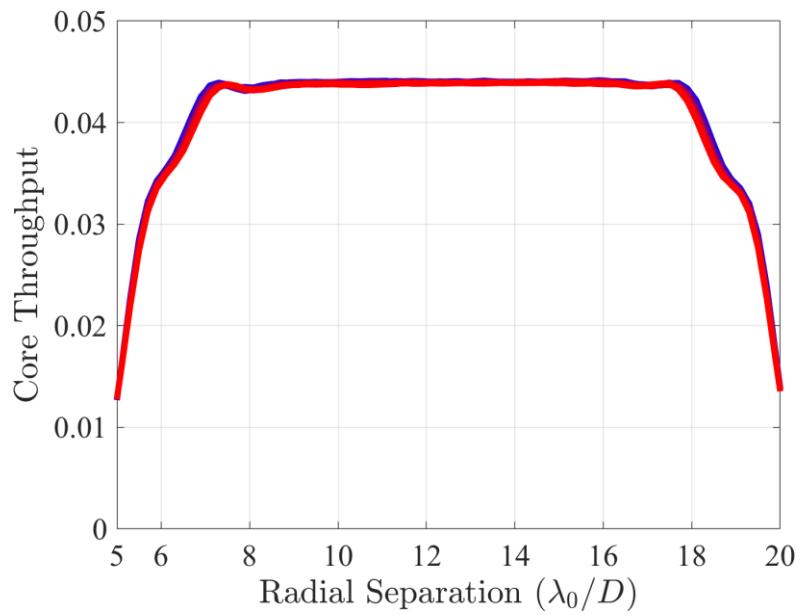


19 wavelengths (one every 1nm) plotted
• Blue to red as wavelength increases

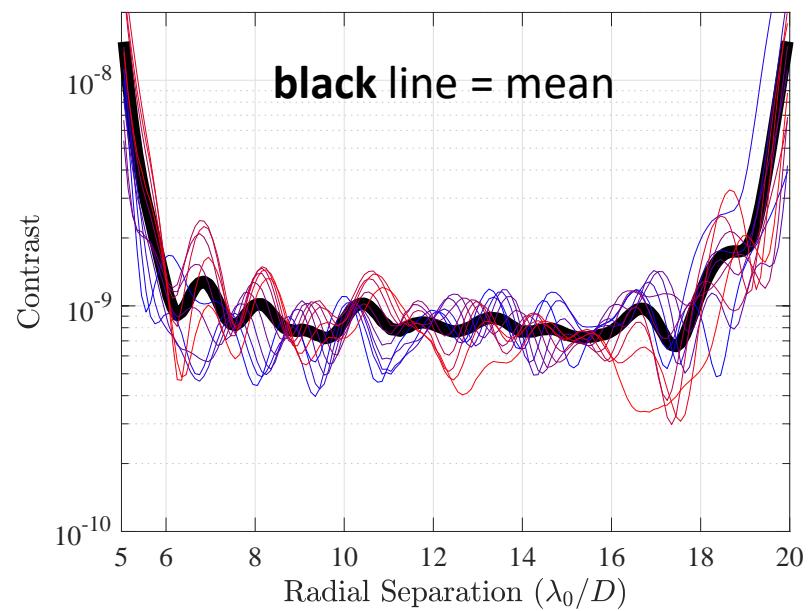


10% Bandwidth Design

Core Throughput



Designed Raw Contrast

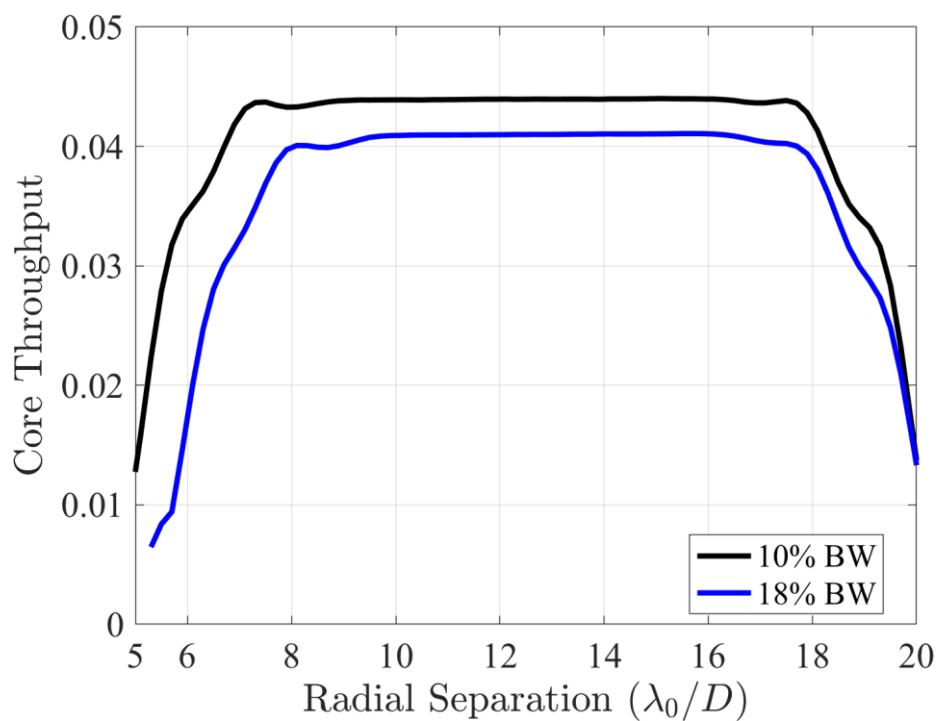


11 wavelengths (one every 1nm) plotted
• Blue to red as wavelength increases



Design Comparison

Mean Core Throughput



Mean Designed Raw Contrast

